USGS
science for a changing world

Western Ecological Research Center http://www.werc.usgs.gov

Sea Otter Studies

Sea otter research by the Western Ecological Research Center (WERC) focuses on this smallest marine mammal's population biology and its role as a keystone species in the nearshore marine community. WERC scientists conducting long-term research in Alaska, California, and Washington seek to answer intricate ecological questions, such as what underlies the collapse of the kelp forest ecosystem in the Aleutian Islands, and why is California's threatened sea otter population growing so slowly. They work with state, federal, and local partners throughout the species' range.

Sea otters once ranged from the central Pacific coast of Baja California, Mexico, to northern Japan, probably in high densities more or less continuously throughout the region. The Pacific maritime fur trade, beginning with the discovery of Alaska and the Aleutian Islands by the Bering Expedition in the mid-1700s, brought sea otters to near extinction by the beginning of the 20th century. After 150 years of being intensively hunted for their valuable fur, sea otters had been extirpated from most of their range. Passage of the International Fur Seal Treaty in 1911 protected remaining sea otters from further hunting, but their distribution was severely fragmented, with remnant populations surviving in Alaska and along the rugged Big Sur coast of California. Later relocations of sea otters restored populations to some areas, including Washington.

A Keystone Species

WERC's sea otter research program has used this fragmented distribution for large-scale studies, contrasting similar habitats with and without sea otters and documenting changes through time as populations became reestablished and grew. Early work demonstrated that sea otters, by limiting populations of herbivorous invertebrates such as sea urchins and large gastropods, were an important factor in preventing kelp forests from being overgrazed.

Sea otter. Photo: Courtesy G. Jameson.

Research is still needed to:

- Determine patterns of mortality during periods of population increase and decline in California
- Understand how demographic shifts translate into changes in population trends
- Better understand the ultimate drivers of sea otter population collapse in western Alaska

Decline in the Aleutians

Long-term research by WERC scientists has documented the extensive and precipitous decline of Aleutian sea otters, 70 percent since 1992 and 95 percent or more throughout much of the Aleutian Islands since the 1980s. Untangling the chain of events that led to the collapse of this sea otter/kelp forest system, WERC scientists discovered that the collapse was driven by increased killer whale predation, and ultimately caused by events in the oceanic ecosystem. Their findings led the U.S. Fish and Wildlife Service (USFWS) to propose the sea otter in western Alaska as a candidate for listing under the Endangered Species Act. Their findings also figured into Bering Sea fishery restrictions by the National Marine Fisheries Service. A fellowship from the Pew charitable trust funds a study on the historical ecology of the Bering Sea ecosystem.

Studies for Recovery in California

In California, current efforts are directed toward understanding reasons for the depressed growth rate of the threatened southern sea otter population. The WERC monitoring program showed a trend reversal from about 1996 onward, the general cause being altered age-specific mortality rates. This discovery has been important to the USFWS in its recovery planning pro-

cess, to the California Department of Fish and Game, the California Coastal Commission, the Monterey Bay Aquarium, the Friends of the Sea Otter, a conglomerate of associated conservation nongovernmental organizations, and a diffuse group of fisheries organizations.

WERC researchers are involved in collaborative studies with scientists from the California Department of Fish and Game, the University of California at Santa Cruz, the University of California at Davis, the USGS National Wildlife Health Center, and the Monterey Bay Aquarium. In new research to learn more about the animal's habits, the scientists implanted radio transmitters and time-depth recorders in dozens of sea otters to monitor their behavior and vital signs as they dive and forage for food. The scientists will compare how populations of otters live and die in contrast with similar populations that were radio-tagged and observed in the 1980s when their numbers were growing. Detailed health profiles are being developed for living animals and beach-cast carcasses are being examined and tissues analyzed, in an effort to determine cause of death. Analyses of these data will help indicate the status of this sea otter population and why it is not increasing.

Comparing Washington and California Otters

In 1969 and 1970, state and federal agencies relocated a total of 59 otters from Alaska to Washington's northwestern coast. The population has been intensively monitored since 1977 and has grown to between 500 and 600 animals. Prior to 1989, the Washington population of sea otters was growing at about 15–20 percent annually, while the California population was growing at only 4–5 percent. Since then the rate of increase in Washington has slowed to about 10 percent, still, however, higher than in California. To discover why these rates vary so greatly, WERC scientists and their collaborators are comparing the behavior and population biology of the Washington population with that in California. They are documenting patterns of population growth or decline, determining the demographic mechanisms responsible for the different rates of population change, and identifying which demographic characteristics are associated with rapidly growing populations and which are more typical of those that are either stable or in decline. Modeling approaches are being developed to predict trends.

Studies on Contaminants, Genes, and Evolution

New collaborative research by scientists at WERC, USFWS, Olympic Coast National Marine Sanctuary, and Washington Department of Fish and Wildlife, with funding from USFWS, will assess contaminant loads in Washington sea otters. In a separate study funded by the U.S. Navy, WERC scientists are studying contaminants in coastal ecosystems of the Aleutian Islands, including sources of contamination and possible long-distance transport of pollutants.

WERC biologists are collaborating with the Seattle Aquarium, and the Makah Tribe in a study contrasting the genetic variation of extant and pre-fur trade sea otter populations. Tissue samples were taken from living sea otters in Washington and Alaska; the historic sample was obtained from the Makah museum in Neah Bay, Washington. Currently efforts are being made to obtain samples from other museum collections that hold material from sea otter populations in California, Alaska, Washington, Oregon, and Russia. A similar study, for which WERC acts as an advisor, is under way in Oregon. The results of these studies will provide for a better understanding of the genetic effects of the population bottlenecks that all sea otter populations experienced during and after the fur trade era.

Sea otters are the key species of WERC study on the evolution of marine living by mammals. Sea otters are the only fully marine-living otter and have close links to terrestrial and semi-aquatic carnivores. In addition, WERC scientists are infusing marine conservation biology with new information and ideas.

To learn more about sea otter research at WERC, visit our web site at http://www.werc.usgs.gov/otters/.

For more information, contact:
Dr. James A. Estes
USGS Santa Cruz Field Station
100 Shaffer Road
Long Marine Laboratory, UCSC
Santa Cruz, CA 95060
Phone: 831.459.2357 Fax: 831.459.2249